

We Claim:

1 1. A method of depositing a low k dielectric film on a substrate, the method
2 comprising
3 flowing a precursor gas containing Si, C, H and an oxygen-providing gas into a
4 PECVD chamber containing a substrate, wherein the precursor gas and the oxygen-
5 providing gas are substantially free of nitrogen, and wherein the oxygen-providing gas is
6 selected from the group consisting of oxygen, carbon monoxide, carbon dioxide, ozone,
7 water vapor and a combination comprising at least one of the foregoing; and
8 depositing a hydrogenated oxidized silicon carbon film on the substrate.

1 2. The method according to Claim 1, wherein the precursor gas is selected from the
2 group consisting of methylsilane, dimethylsilane, trimethylsilane, tetramethylsilane,
3 1,3,5,7-tetra-methyl-cyclo-tetra-siloxane, tetraethylcyclotetrasiloxane, and
4 decamethylcyclopentasiloxane silanes and combinations comprising at least one of the
5 foregoing.

1 3. The method according to Claim 1, wherein the precursor gas is selected from the
2 group consisting of methylsilane, dimethylsilane, trimethylsilane, tetramethylsilane, and
3 combinations comprising at least one of the foregoing.

1 4. The method according to Claim 1, further comprising heating the PECVD
2 chamber to a temperature ranging from 25°C to 500°C.

1 5. The method according to Claim 1, wherein the oxygen-providing gas is selected
2 from the group consisting of oxygen, carbon monoxide, water vapor, carbon dioxide and
3 a combination comprising at least one of the foregoing.

1 6. The method according to claim 1 wherein the precursor gas comprises an
2 organosilicon compound having a ring structure selected from the group consisting of
3 1,3,5,7-tetramethylcyclotetrasiloxane, tetraethylcyclotetrasiloxane, and
4 decamethylcyclopentasiloxane.

1 7. The method according to claim 1, wherein the hydrogenated oxidized silicon
2 carbon film has a dielectric constant less than 3.5.

1 8. The method according to claim 1, wherein the hydrogenated oxidized silicon
2 carbon film has a dielectric constant less than 3.0.

1 9. The method according to claim 1, wherein the hydrogenated oxidized silicon
2 carbon film has a dielectric constant of about 2.7.

1 10. The method according to claim 1, wherein the hydrogenated oxidized silicon
2 carbon film is free from amine functionalities.

1 11. The method according to Claim 1, further comprising annealing the hydrogenated
2 oxidized silicon carbon film at a temperature greater than 300°C.

1 12. The method according to Claim 1, wherein the plasma enhanced chemical vapor
2 deposition chamber is a parallel plate plasma reactor.

1 13. The method according to Claim 1, further comprising flowing a diluent gas.

1 14. The method according to Claim 13, wherein the diluent gas is selected from the
2 group consisting of helium, argon, xenon, and krypton.

1 15. The method according to Claim 1, wherein a flow rate ratio of the precursor gas to
2 the oxygen providing gas is from about 10 : 1 to about 1: 5.

1 16. The method according to Claim 1, wherein the hydrogenated oxidized silicon
2 carbon film is non-polymeric.

1 17. A method of depositing a low k dielectric film on a substrate, the method
2 comprising
3 providing a substrate in a PECVD chamber;
4 flowing a precursor gas containing Si, C, H, an oxygen-providing gas, and a
5 carrier gas into the PECVD chamber, the precursor gas and the oxygen-providing gas
6 being substantially free of nitrogen and, wherein the oxygen-providing gas is selected
7 from the group consisting essentially of oxygen, carbon monoxide, carbon dioxide, water
8 and combinations of at least one of the foregoing; and
9 depositing a nitrogen-free SiCOH dielectric film onto the substrate, wherein the
10 SiCOH dielectric film includes a dielectric constant less than 3.5.

1 18. The method according to Claim 17, wherein the precursor gas is selected from the
2 group consisting of methylsilane, dimethylsilane, trimethylsilane, tetramethylsilane, and
3 combinations of at least one of the foregoing.

1 19. The method according to Claim 17, wherein the nitrogen-free SiCOH dielectric
2 film comprises a hydrogenated oxidized silicon carbon film.